

BRACHYNOTUS GEMMELLARI (RIZZA, 1839), THE
THIRD MEDITERRANEAN SPECIES OF THE GENUS
(CRUSTACEA, DECAPODA, BRACHYURA)

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Abstract.—*Brachynotus gemmellari* (Rizza, 1839) is removed from the synonymy of *B. sexdentatus* (Risso, 1827) and is differentiated from that species as well as from *B. foresti* Zariquiey Alvarez, 1968. The latter two species inhabit intertidal habitats in the Mediterranean; *B. gemmellari* occurs sublittorally. A neotype is selected for *B. gemmellari*.

Three Mediterranean-Atlantic species are currently recognized in the grapsid genus *Brachynotus* De Haan, 1833 [type-species, by subsequent monotypy, *Goneplax sexdentatus* Risso, 1827]: *B. sexdentatus* and *B. foresti* Zariquiey Alvarez, 1968, from the Mediterranean, and *B. atlanticus* Forest, 1957, from localities in the adjacent Atlantic Ocean along the African coast; all three of these species are generally found in the intertidal zone.

Our samples of *Brachynotus* from several different localities in the Mediterranean have revealed the presence of a third species there, a relatively long legged species which generally occurs sublittorally on soft bottoms. We believe that this species can be identified with *Cleistotoma gemmellari* Rizza, 1839, originally described from eastern Sicily. Rizza's name until now was considered to be a synonym of *B. sexdentatus*. *Brachynotus gemmellari* was first encountered by one of us (C.F.) in trawl samples taken in the Adriatic in depths between 4 and 16 m.

Because more detailed studies of Mediterranean Brachyura are now being carried out by both of us, we are restricting our accounts of the three Mediterranean species of *Brachynotus* to abbreviated synonymies, including some older references as well as those published since the monograph on Spanish decapods by Zariquiey Alvarez (1968), differential diagnoses, sketches, lists of material, and comments on habitat and general biology. We hope that these preliminary notes will aid other students of Mediterranean decapods in distinguishing these species.

Part of the field study which provided some of the specimens reported here was carried out by one of us (R.B.M.) from Tunisia between 1972 and 1974 with the support of the Foreign Currency Program of the Smithsonian Institution. Field work in Tunisia was carried out with the collaboration of the Institut National Scientifique et Technique d'Océanographie et des Pêches, Salammbô, under the direction of A. Azouz. Field work in Algeria was carried out with the assistance of Ms. Rabia Seridji and the support of M. S. Tellai, Director, Institut Océanographique, Al-

giers. Their cooperation is gratefully acknowledged. We thank J. Forest, Muséum National d'Histoire Naturelle, Paris (MNHN), for the loan of material. We thank L. B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden, for comments on the manuscript. The illustrations were prepared by Lilly King Manning.

In the lists of material given below, material deposited in the Laboratorio di Tecnologia della Pesca, Ancona, is identified by the acronym LTP and that deposited in the National Museum of Natural History, Smithsonian Institution, Washington, is identified by the acronym USNM. The neotype of *Cleistotoma gemmellari* has been deposited in the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH). The abbreviations cl. and cb. are used for carapace length and carapace width, respectively.

In our sections on "Material," coordinates not given in original data as well as alternate spellings, both taken from gazetteers of the U.S. Board of Geographic Names, are given in brackets.

Key to Mediterranean Species of *Brachynotus*

1. Front strongly sinuous, median notch well marked (Fig. 1a). Surface of carapace highly sculptured. Hepatic region distinctly swollen. Third anterolateral tooth of carapace low, blunt. Male gonopod with obtuse prominence subdistally, lacking distinct, convex shoulder (Fig. 2c, d) *B. foresti*
- Front faintly sinuous, median notch broad, poorly defined (Fig. 1d). Surface of carapace smooth, regions low, poorly marked. Hepatic region not swollen. Third anterolateral tooth of carapace distinct, acute or spiniform. Male gonopod with distinct, convex subdistal shoulder (Fig. 2g, k) 2
2. Pereiopods long, slender (Fig. 1e, f), merus of fifth half or more than half (more than half in females) as long as carapace, propodus of fifth 1.55–2.30 (mean 1.88) times longer than broad *B. gemmellari*
- Pereiopods short, stout (Fig. 1h, j), merus of fifth half or less than half as long as carapace, propodus of fifth 1.35–1.80 (mean 1.61) times longer than broad *B. sexdentatus*

Brachynotus foresti Zariquiey Alvarez, 1968

Figs. 1a–c, 2a–d, 3, 4

Brachynotus sexdentatus ssp.—Holthuis & Gottlieb, 1958:102 [Israel].—Holthuis, 1961:59 [Greece].—Lewinsohn & Holthuis, 1964:60 [Israel] [not *Brachynotus sexdentatus* (Risso, 1827)].

Brachynotus sp.—Forest, 1967:9, 28 [footnote] [Gulf of Taranto; Izmir, Turkey].—Geldiay & Kocatas, 1968:6, figs. 2a,c,e, fig. 1 on pl. [Turkey].

Brachynotus foresti Zariquiey Alvarez, 1968:431, figs. 142d,e, 143b–d, 145

[Spain; references].—Kocatas, 1971:31, pl. 5 fig. 2 [Turkey].—Georgiadis & Georgiadis, 1974: fig. 5 [distribution].—Kattoulas & Koukouras, 1975: 301 [Greece].—Frogliia, 1926:172, fig. 2 [Adriatic coast of Italy].—*?Branchinotus foresti*.—Pastore, 1976:113 [erroneous spelling; ?part].

Material.—Middle Adriatic, Italy: Ancona, Falconara Marittima [43°38'N, 13°24'E], Disco beach, on pipe for domestic sewage, among mussels, depth 0.5 m, 11 May 1973, C. Frogliia leg.: 3♂, cl. 3.5–8.0 mm, 1♀, cl. 5.0 mm (LTP); 1♂, cl. 6.2 mm, 3♀, cl. 6.9–7.3 mm (USNM).—Same locality, 23 October 1973: 5♂, cl. 6.2–8.0 mm, 6♀, cl. 6.7–8.0 mm (LTP).—Same locality, 11 July 1974: 1 ovigerous ♀, cl. 9.0 mm (LTP).—Same locality, 4 March 1975: 1♂, cl. 3.8 mm, 2♀, cl. 3.4–4.2 mm (LTP).

Ortona [42°21'N, 14°24'E] harbor, near the shipyard, among mussels and algae, depth 0.5 m, 7 July 1973, C. Frogliia leg.: 8♂, cl. 6.2–11.2 mm, 5♀, cl. 5.6–7.5 mm (3 ovigerous, cl. 6.9–7.5 mm) (LTP).

Tunisia: Gabès [33°53'N, 10°07'E], port, sandy mud and protected rocky shore, intertidal, under rocks on sand, 5 June 1973, Sta. RBM Tun-143, R. B. Manning, C. Frogliia, and M. Jeddi, leg.: 1♀, cl. 7.2 mm (USNM).

Djerba Island, N coast, on dirt road between Houmt Souk [33°53'N, 10°51'E], and Bordj Djillidi, 2 km from Houmt Souk, on and under stones on sand, shore to 0.67 m, 23 August 1973, Sta. RBM Tun-213A, R. B. and Marian Manning, M. L. Jones, M. Jeddi, leg.: 3♂, cl. 6.9–8.5 mm (USNM).—Djerba Island, isolated rocky platform about 2 km W of Houmt Souk, between there and airport, rocky platform grading into *Cymodocea*, shore to 1 m, 7 June 1973, sta. RBM Tun-153, R. B. Manning, C. Frogliia, M. Jeddi leg.: 2♂, cl. 8.4–9.2 mm, 1 ovigerous ♀, cl. 7.1 mm (USNM).

Zarzis [33°30'N, 11°07'E], in front of Hotel Sidi Saad, rocky limestone platform, under rocks exposed at low tide, 25 August 1973, Sta. RBM Tun-218C, R. B. and Marian Manning, M. L. Jones, M. Jeddi leg.: 13♂, cl. 3.0–6.9 mm, 4♀, cl. 3.1–6.9 mm (1 ovigerous, cl. 6.5 mm) (USNM).

Algeria: Tamentefous [Bordj Tamentefous; 36°48'N, 03°14'E], across bay from Algiers, beach, under rocks at shore, 10 May 1974, Sta. RBM Alg-10B, R. B. Manning, M. Jeddi, R. Seridji, and J. Quelers leg.: 1♀ juv., cl. 6.5 mm (USNM).

Diagnosis.—Size relatively small, maximum cl. less than 12 mm. Carapace (Fig. 1a) strongly sculptured, surface uneven, regions more or less distinct. Adult males and females with distinct, transverse tuberculate branchial ridge extending mesially from third anterolateral tooth. Frontal lobes strongly convex, median emargination deep. Frontorbital width ranging from 1.95–2.13 (mean 2.03) times frontal width. Third anterolateral tooth of carapace blunt. Pereiopods (Fig. 1b, c) short, merus of fifth half or less than half as long as carapace, stout, propodus of fifth 1.30–1.67 (mean 1.40) times longer than broad. Females generally with slenderer

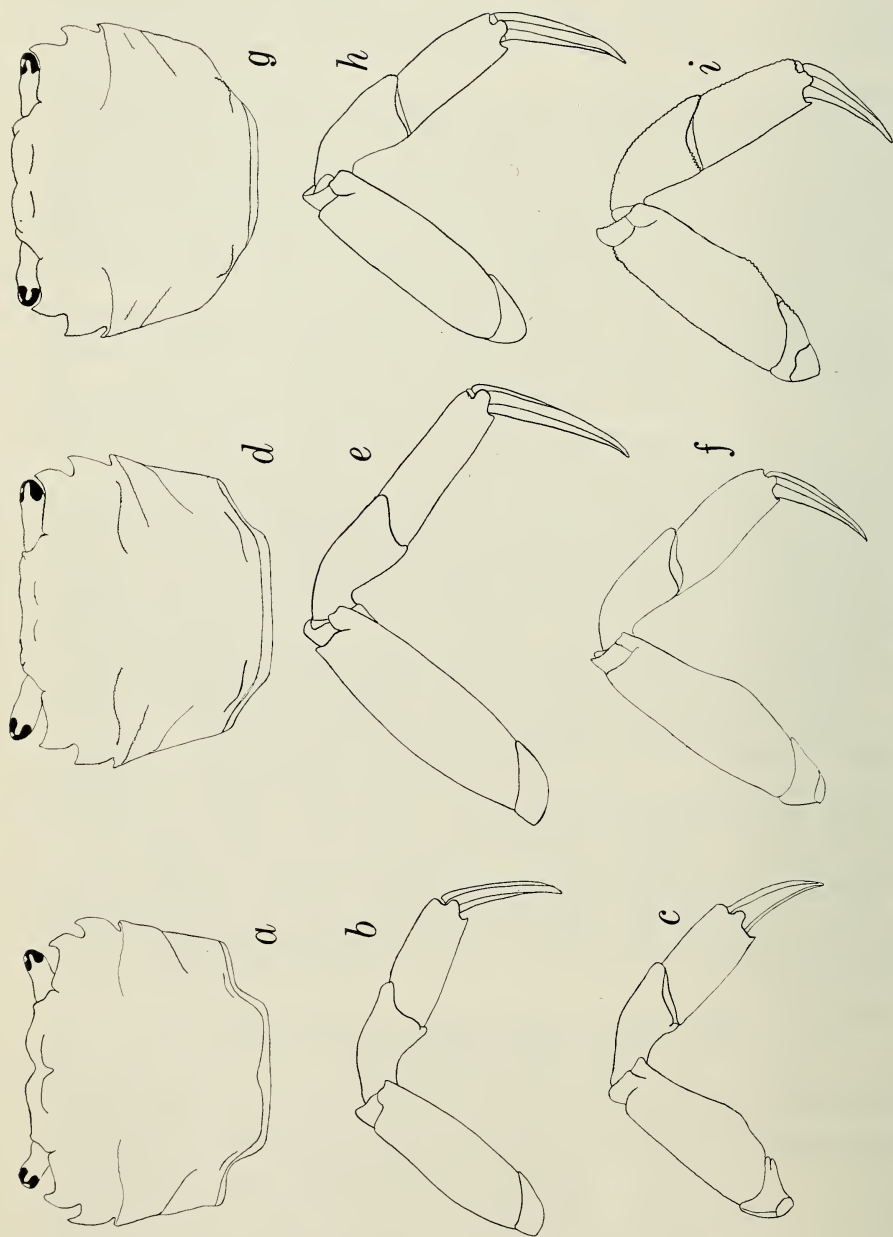


Fig. 1. Dorsal view of carapace (*a, d, g*), second pereiopod (*b, e, h*), and fifth pereiopod (*c, f, i*) of females of: *a-c, B. gemmellari*, ovigerous ♀, cl. 8.5 mm; Tunisia; *d-f, B. foresti*, cl. 11.5 mm, Adriatic Sea; *g-i, B. sexdentatus*, cl. 10.0 mm, Sicily.

walking legs than males. Male pleopod (Fig. 2c, d) with low prominence subdistally, lacking distinct shoulder.

Size.—Carapace lengths of males 3.0–11.2 mm, of females 3.1–9.0 mm, of ovigerous females 6.5–9.0 mm. The largest specimen recorded so far is the largest male reported here, cl. 11.2 mm (also reported by Frogliia, 1976); Holthuis & Gottlieb (1958) reported specimens from Israel measuring cl. 2.5–11 mm. This is a smaller species than either *B. gemmellari* or *B. sexdentatus*.

Distribution.—Mediterranean Sea, from localities between Spain and Israel, suggesting that it could occur anywhere in the Mediterranean in suitable habitats; littoral.

Brachynotus gemmellari (Rizza, 1839)

Figs. 1d–f, 2e–h, 3, 4, 5

Cleistotoma gemmellari Rizza, 1839:372 [eastern Sicily].

Brachynotus sexdentatus.—Forest & Guinot, 1956:41 [Tunisia, 5–10 m].—Bacescu, 1967:321 [Black Sea; part, records from 6 m or more].—Geldiay & Kocatas, 1968:5 [Turkey; part, records from more than 6–7 m].—Kocatas, 1971:30, pl. 5 fig. 4 [Turkey].—Geldiay & Kocatas, 1972:13, 14, 15 [Turkey; part, records from more than 5 m].—?Georgiadis & Georgiadis, 1974:242 [table], 246 [Greece; ?part, specimens from more than 4 m] [not *Brachynotus sexdentatus* (Risso, 1827)].

Brachynotus sp. Georgiadis & Georgiadis, 1974:fig. 5 [?part; distribution of *Brachynotus*].

Brachynotus foresti.—Pastore, 1976:108 [listed] [not *Brachynotus foresti* Zariquiey Alvarez, 1968].

Branchynotus foresti.—Pastore, 1976:113 [erroneous spelling] [Gulf of Taranto, 12 m; part?] [not *Brachynotus foresti* Zariquiey Alvarez, 1968].

Material.—Northern Adriatic, Italy: Off Po delta, 44°53.7'N, 12°32.7'E, 12 m, muddy sand, 29 July 1973: 7♂, cl. 2.4–9.3 mm, 3 ovigerous ♀, cl. 6.6–8.6 mm (LTP).

Entrance of Ravenna Harbor [44°25'N, 12°12'E], 4 m, sand, 5 October 1974: 1♂, cl. 3.5 mm, 1♀, cl. 5.3 mm (LTP).

Off Cesenatico, 44°16.6'N, 12°28.5'E, 12 m, sandy mud, 27 July 1973: 6♂, cl. 8.5–12.5 mm, 6 ovigerous ♀, cl. 8.6–11.0 mm (LTP).

Off Cattolica, 44°02.8'N, 12°46'E, 13 m, sandy mud, 26 July 1973: 7♂, cl. 9.4–11.5 mm, 4♀, cl. 9.0–10.2 mm (1 ovigerous, cl. 9.3 mm) (1♂, 1♀ parasitized by sacculinids) (LTP).

Middle Adriatic, Italy: Off Pesaro, 43°52.2'N, 13°07.1'E to 43°55'N, 13°00'E, 14 m, muddy sand, trawl, 30 September 1974: 4♂, cl. 3.0–6.4 mm, 3♀, cl. 4.6–11.0 mm (1♀ parasitized by sacculinids) (LTP).

43°47'N, 13°12.1'E to 43°50.4'N, 13°07.3'E, 13 m, muddy sand, 26 July

1973: 6♂, cl. 8.0–12.0 mm, 6♀, cl. 7.4–10.4 mm (LTP); 6♂, cl. 8.5–12.7 mm, 6♀, cl. 8.0–11.5 mm (2 ovigerous, cl. 9.3–11.5 mm) (4♀ parasitized by sacculinids) (USNM).

Three miles off Ancona [43°38'N, 13°30'E], 15 m, 7 July 1969, C. Frogliola leg.: 1♂, cl. 8.2 mm, 4♀, cl. 8.9–9.9 mm (3 parasitized by sacculinids) (USNM).

Off Falconara Marittima [43°38'N, 13°24'E], 7 m, sand, 17 April 1973: 1♂, cl. 9.1 mm, 3♀, cl. 5.9–6.4 mm (LTP).

Off Conero Promontory [43°33'N, 13°36'E], 15 m, sandy mud, trawl, 29 April 1971: 1♂, cl. 4.8 mm, 2♀, cl. 3.4–6.6 mm (LTP).

Southern Adriatic, Italy: Off Lago di Varano [41°53'N, 15°45'E], 15 m, sand, trawl, 4 August 1974: 5♂, cl. 10.7–15.7 mm, 2 ovigerous ♀, cl. 11.0–12.3 mm (1♂ parasitized by sacculinid) (LTP).

Golfo di Manfredonia, off Mattinata [41°42'N, 16°03'E], 10 m, sand with *Cymodocea nodosa*, 1 August 1974: 13♂, cl. 12.6–15.4 mm, 12♀, cl. 10.1–14.4 mm (6 ovigerous, cl. 12.6–14.4 mm) (2♀ parasitized by sacculinids), 1 hermaphrodite, cl. 11.2 mm (LTP). ♂, cl. 15.4 mm, is Neotype, RMNH Crust. D. 31719.

Tunisia: Salammbô [36°51'N, 10°19'E], northern Punic Port, sand and mud flat, 25 April 1974, Sta. RBM Tun-339, R. B. Manning leg.: 2♂, cl. 7.0–11.2 mm (USNM).

Gulf of Tunis, off Salammbô [36°51'N, 10°19'E] and Kherredine [36°50'N, 10°19'E], 7–10 m, sand and grass, Zariquiey dredge, 28 February 1974, Sta. RBM Tun-320, R. B. Manning, R. W. and Eileen Ingle leg.: 1♂, cl. 7.2 mm (USNM).

Gulf of Gabès, off Gabès and Zarat, 33°45.5'N, 10°24'E, 21 m, 27 June 1973, *El Maghreb* sta. R9-2, M. Jeddi leg.: 1♂, cl. 7.5 mm (USNM).

Diagnosis.—Size relatively large, maximum cl. about 16 mm. Carapace (Fig. 1d) smooth, regions poorly marked. Adult females with distinct, transverse, tuberculate branchial ridge extending mesially from third anterolateral tooth, ridge absent in males. Frontal lobes strongly convex, median emargination well marked but shallow. Frontorbital width ranging from 2.25–2.80 (mean 2.36) times frontal width. Third anterolateral tooth of carapace distinct, rarely sharp. Pereiopods (Fig. 1e, f) long, merus of fifth half or more than half as long as carapace (generally more than half in females), slender, propodus of fifth 1.55–2.30 (mean 1.88) times as long as broad, legs of females slenderer than in males. Male pleopod (Fig. 2g, h) tapering evenly to apex, with low shoulder subdistally.

Size.—Carapace lengths of males 2.4–15.7 mm, of females 3.4–14.4 mm, of ovigerous females 6.6–14.4 mm. This is a relatively large species, larger than *B. foresti* but smaller than *B. sexdentatus*.

Remarks.—In 1839 Alessandro Rizza described, under the name *Cleistotoma Gemmellari*, a species of *Brachynotus* collected from several localities

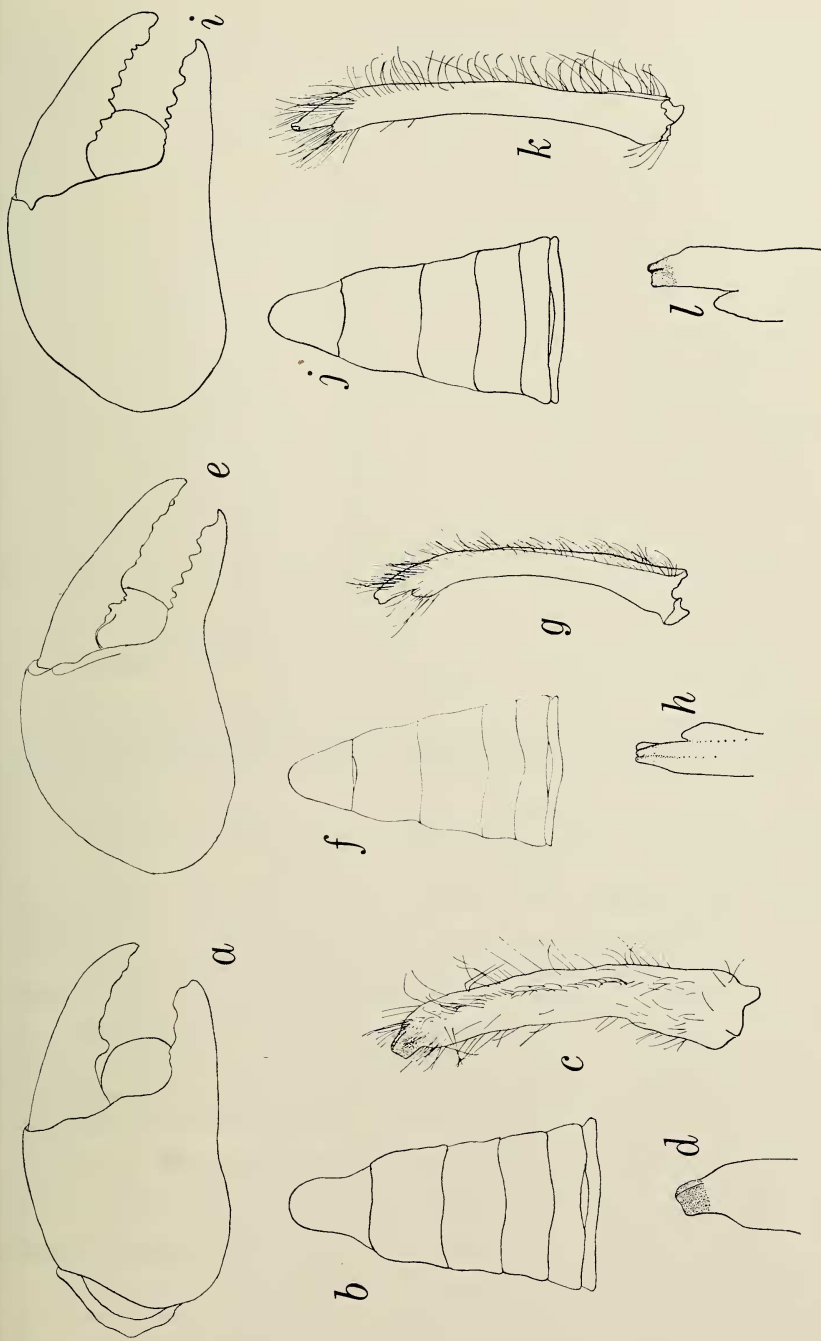


Fig. 2. Outer face of chela (*a*, *e*, *i*), abdomen (*b*, *f*, *j*), gonopod (*c*, *g*, *k*), and apex of gonopod (*d*, *h*, *l*) of males of: *a*-*d*, *B. foresti*, cl. 10.4 mm Tunisia; *e*-*h*, *B. gemmellari*, cl. 11.6 mm Adriatic Sea; *i*-*l*, *B. sexdentatus*, cl. 12.8 mm, Sicily.

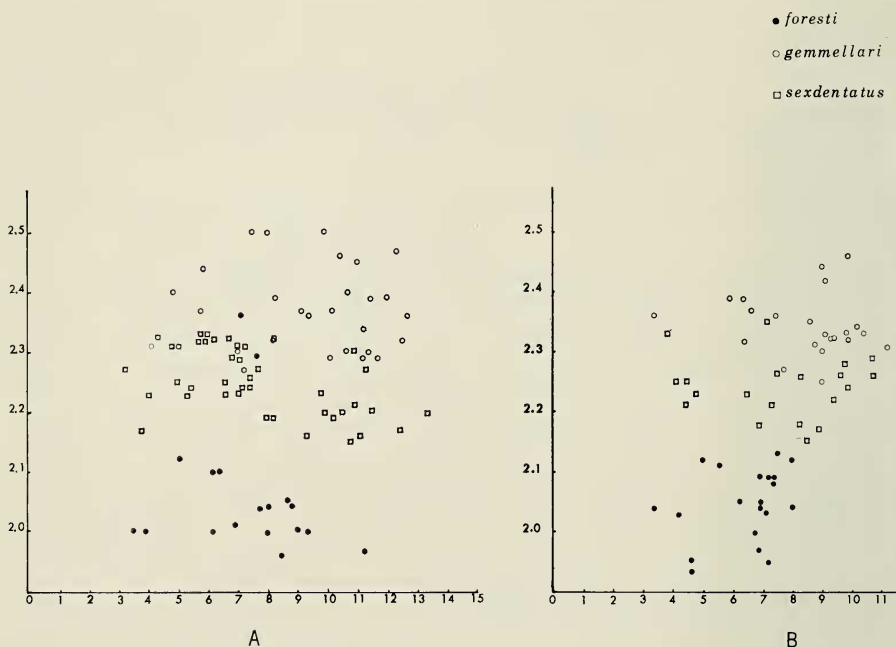


Fig. 3. Ratio of carapace length (abscissa) to frontorbital width in Mediterranean species of *Brachynotus*: A, males; B, females.

off the eastern coast of Sicily. Although *B. gemmellari* is now considered to be a synonym of *B. sexdentatus*, we believe that Rizza's account applies best to the deep water, long-legged species we recognize here rather than to either of the two short-legged, shallow water species of *Brachynotus* from the Mediterranean, *B. foresti* or *B. sexdentatus*.

As in the case of many older accounts, Rizza's description does not fit our material exactly. However, he noted that the front was slightly sinuous (p. 372), "fronte poco inclinata, appena sinuosa nel mezzo," a description which could apply to *B. sexdentatus* but not to *B. foresti*, which has a relatively deep median emargination on the front. The color reported for *B. gemmellari* by Rizza (p. 373), "Colore del corpo cinereo, con le membre più chiare o color di cera," is that found in our material of *Brachynotus* from relatively deep water; the shallow water species in the Mediterranean are generally uniform brownish in color.

The color, the fact that Rizza's material may have been collected sublittorally (he also reported other sublittoral species such as *Inachus communissimus* Rizza from the same area), and the availability of Rizza's name lead us to apply it to our long-legged, sublittoral species rather than introducing a new name. In order to settle the identity of *Cleistotoma gemmellari*, we here select a neotype for the species, a male cl. 15.4 mm, cb. 18.5

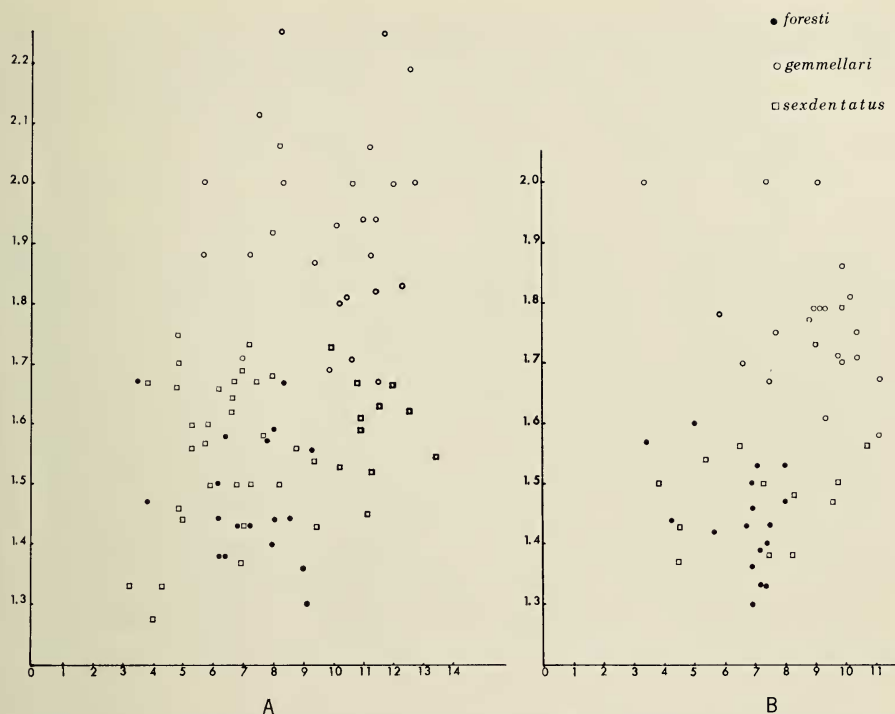


Fig. 4. Ratio of length to width of propodus of fifth pereopod in Mediterranean species of *Brachynotus*: A, males; B, females. Ratio in ordinate, carapace length in abscissa.

mm, from Italy, Golfo di Manfredonia, off Mattinata [41°42'N, 16°03'E], 10 m, on sand with *Cymodocea nodosa*, collected on 1 August 1974 by C. Frogia. The neotype has been deposited in the Rijksmuseum van Natuurlijke Historie, Leiden, under registry number Crust. D. 31719.

Brachynotus gemmellari, as shown in Figs. 1d-f and 2e-h, and as indicated in the key, above, can be distinguished readily from the other Mediterranean species of the genus. Two ratios, plotted in Figs. 3 and 4, carapace width vs frontorbital width and the length/width ratio of the propodus of the fifth pereopods, show some of the differences we have observed. The slenderness and length of the walking legs also are distinguishing features of the species. Finally, its habitat may also be diagnostic. We suspect that almost any *Brachynotus* from depths greater than 5 m will prove to belong to this species rather than to either *B. foresti* or *B. sexdentatus*.

Inasmuch as our collections indicate that neither *B. foresti* nor *B. sexdentatus* occurs in depths greater than a meter or two, we have to conclude that material identified with *B. sexdentatus* by the following authors is all or

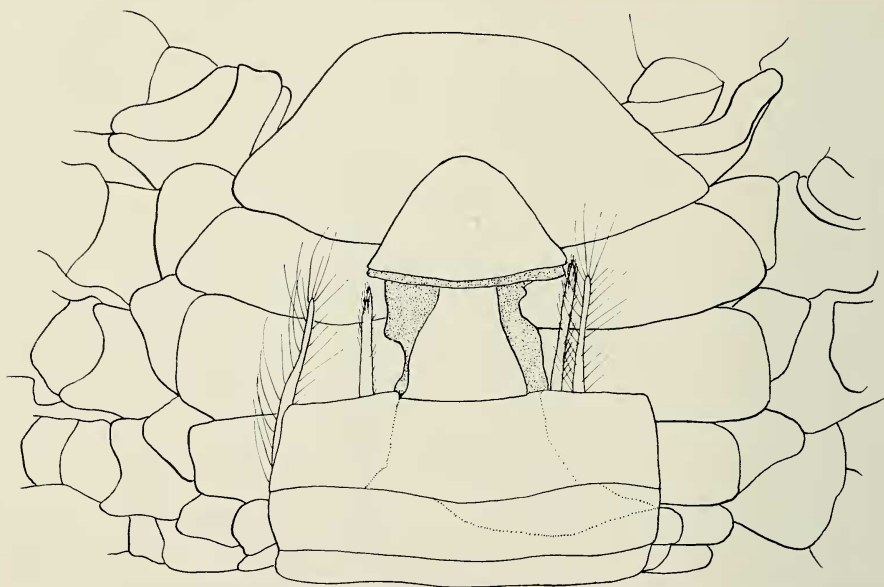


Fig. 5. Sternal view of gynandromorph *B. gemmellari*, cl. 11.2 mm, Gulf of Manfredonia.

in part based on *B. gemmellari*: Forest & Guinot, 1956 (Gulf of Tunis, 5–10 m); Bacescu, 1967 (Black Sea, several records below 6 m); and Geldiay & Kocatas, 1968, 1972, and Kocatas, 1971 (Bay of Izmir, Turkey, several records from below 6–7 m). It also seems most likely that the material identified with *B. foresti* from 12 m in the Gulf of Taranto by Pastore (1976) also is *B. gemmellari*.

Kocatas (1971) illustrated *B. foresti* (Pl. 5 fig. 2) and *B. gemmellari* (Pl. 5 fig. 4, as *B. sexdentatus*) from Izmir Bay, Turkey, and his figures clearly show the difference in leg size and proportions in the two species.

One of our specimens of *B. gemmellari* from off Mattinata, Golfo di Manfredonia, in 10 m, is a hermaphrodite, with a highly modified abdomen and a small chela of the typical female form. The specimen, measuring cl. 11.2 mm, cb. 12.3 mm, has the first pleopods of a male, whereas the second pleopods are biramous, typical of those found in females. A sternal view of this specimen is shown in Fig. 5.

In the Adriatic Sea *B. gemmellari* is very common on the intralittoral fishing grounds of the western side and it is actively preyed upon by many fishes of high commercial value such as turbot, plaice, gurnard and eel.

Distribution.—Mediterranean, where it is known with certainty from localities in the Adriatic Sea, eastern Sicily, and off Tunisia; usually sublittoral, in depths between 4 and 21 m. If our identifications of records in

the literature are correct, it also occurs in the Gulf of Taranto, the Black Sea, and off Greece and Turkey. It, too, could be expected to occur throughout the Mediterranean where suitable habitats can be found.

Brachynotus sexdentatus (Risso, 1827)

Figs. 1*g*–*i*, 2*i*–*l*, 3, 4

Goneplax sexdentatus Risso, 1827:13 [Nice].

Brachynotus sexdentatus.—Lewinsohn & Holthuis, 1964:60 [Israel].—Bacescu, 1967:321, figs. 7, 10A,C,D, 11A–C, 12A, 14G,H, 136, 137A,B, 138A [Black Sea; part, shallower records only].—Zariquiey Alvarez, 1968:431, figs. 142a–c, 143a, 144 [Spain; references].—Geldiay & Kocatas, 1968:5, figs. 1, 2b,d,f, figs. 2–3 on pl.; 1972:13, 14, 17, 29 [both Turkey; part, shallow records only].—Stevcic, 1969:132 [Adriatic; listed]; 1971:528 [Yugoslavia], 530 [listed]; 1973:115, 116 [Yugoslavia].—?Koukouras, 1973:762, table 1 [Greece; part?].—?Georgiadis & Georgiadis, 1974:242 [table], 246, figs. 5–7 [Greece; possibly more than 1 species].—Kattoulas & Koukouras, 1975:300 [Greece].—Pastore, 1976:106, 108, 113 [Gulf of Taranto; part, shallow records only].—Ramadan & Dowidar, 1976:133 [Egypt].

Material.—Mediterranean Sea: No other data: 2♂, cl. 11.1–17.0 mm (USNM).

Northern Adriatic, Yugoslavia: Canal di Leme [Limski Canal, 45°07'N, 13°38'E], shallow flat at upper end of canal, under stones at low tide, 21 March 1973, Sta. RBM Yugo-11, Barbara, Elaine, and R. B. Manning, C. Froglija, and Z. Stevcic leg.: 5♂, cl. 4.8–8.2 mm, 2♀, cl. 5.8–6.4 mm (1♂, 1♀ parasitized by sacculinids) (LTP); 25♂, cl. 3.3–7.9 mm, 26♀, cl. 3.0–8.3 mm (1♂, 3♀ parasitized by sacculinids) (USNM).

Northern Adriatic, Italy: Porto Garibaldi [44°41'N, 12°14'E], among mussels and fouling organisms of the harbor, depth 1 m, 17 September 1972, C. Froglija leg.: 2♂, cl. 5.8–7.7 mm, 1♀, cl. 5.3 mm (LTP).—Locality same, 0.5 m, 10 October 1974, C. Froglija leg.: 11♂, cl. 3.7–7.0 mm, 5♀, cl. 4.0–5.1 mm (LTP).

Marina di Ravenna [44°25'N, 12°12'E], along piers, among fouling organisms, depth 0.5 m, 4 October 1974, C. Froglija leg.: 11♂, cl. 2.7–6.6 mm, 21♀, cl. 3.5–7.7 mm (LTP).

Southern Adriatic, Italy: Manfredonia Harbor [41°38'N, 15°55'E], among fouling organisms, depth 0.5–1.0 m, 8 July 1974, C. Froglija leg.: 3♂, cl. 5.9–7.2 mm, 3♀, cl. 6.9–7.5 mm (LTP).

Brindisi Harbor [40°39'N, 17°57'E], near port office, among fouling organisms, depth 0.5–1.0 m, 2 August 1974, C. Froglija leg.: 21♂, cl. 2.7–13.8 mm, 12♀, cl. 4.3–12.6 mm (3 ovigerous, cl. 10.1–12.0 mm) (LTP).

Sicily: Trapani, 38°00.5'N, 12°31.1'E, on seawall at mouth of canal from

old salt ponds opening on southern edge of harbor, 17 June 1974, RBM Ital-16, C. Froglià and R. B. Manning leg.: 6♂, cl. 8.8–12.5 mm, 3♀, cl. 8.5–10.7 mm (LTP); 2♂, cl. 10.8–11.3 mm, 2♀, cl. 8.3–8.9 mm (USNM).

Italy: Naples [Naples Bay, 40°48'N, 14°16'E], Vimont leg.: 3♂, cl. 12.4–16.9 mm (MNHN).

Spain: Port of Barcelona [41°23'N, 02°11'E], July 1957, R. Zariquiey leg.: 1♂, cl. 10.1 mm, 1 ovigerous ♀, cl. 9.9 mm (USNM).

Tunisia: Salammbô [36°51'N, 10°19'E], southern Punic Port, under rocks along entrance channel, intertidal, 6 October 1972, Sta. RBM Tun-51, R. B. Manning, L. B. Holthuis leg.: 8♂, cl. 4.7–9.1 mm, 6♀, cl. 2.3–9.3 mm (2 ovigerous, cl. 7.0–9.3 mm) (USNM).

Salammbô, intertidal area outside and N of northern Punic Port, under loose rocks on sand, 15 May 1973, Sta. RBM Tun-123, R. B. and Lilly Manning leg.: 4♂, cl. 4.8–5.8 mm, 2♀, cl. 5.5–5.9 mm (1 ovigerous, cl. 5.5 mm) (USNM).—Locality and habitat same, 8 August 1973, Sta. RBM Tun-196B, R. B. Manning and J. Forest leg.: 2♂, both cl. 7.3 mm, 1 ovigerous ♀, cl. 6.7 mm (USNM).

Algeria: Rade d'Alger [36°47'N, 03°03'E] et de Bône [Golfe de Bône, 36°55'N, 07°50'E], Lucas leg. (types of *Heterograpsus Lucasi* ?): 3♂, cl. 7.8–9.6 mm, 1♀, cl. 9.2 mm (MNHN).

Diagnosis.—Size relatively large, maximum cl. to more than 20 mm. Carapace (Fig. 1g) smooth, regions poorly marked. Adult females with distinct, transverse, tuberculate branchial ridge extending mesially from third anterolateral tooth, ridge absent in adult males. Frontal lobes convex but short, median emargination shallow. Frontorbital width ranging from 2.10–2.35 (mean 2.24) times frontal width. Third anterolateral tooth of carapace usually sharp. Pereiopods (Fig. 1h, i) short, merus of fifth half or less than half as long as carapace in both sexes, stout, propodus of fifth 1.35–1.80 (mean 1.61) times longer than broad. Male pleopod (Fig. 2k, l) with broad, rounded, projecting subdistal shoulder.

Size.—Carapace lengths of males 2.7–17.0 mm, of females 2.3–12.3 mm, of ovigerous females 5.5–12.0 mm. Lewinsohn & Holthuis (1964) recorded specimens from Israel measuring cl. 7–11 mm, and Forest (1957) recorded a male from Naples, cl. 20.5 mm.

Remarks.—At least two of the records cited above, those of Koukouras (1973) and Georgiadis & Georgiadis (1974), are based on material from several different localities off Greece. We are not able to determine from these accounts whether or not their material included representatives of more than one species. At least part of the material of this species reported by Bacescǔ (1967) from the Black Sea is referable to *B. gemmellari*. So far as we can determine, Naylor (1957) was correct in identifying his material, apparently introduced to Swansea, England, with this species. Whether or not *B. sexdentatus* has established a breeding population in England remains to be determined.

Calman (1927) reported that this species had entered the northern part of the Suez Canal.

Distribution.—Mediterranean Sea, from numerous localities between Spain and Israel, including the Black Sea and the northern part of the Suez Canal; introduced into England; littoral, generally under stones or burrowing in sand.

General Remarks

Adult males of all of the Mediterranean species of *Brachynotus* have an inflated vesicle on the inner face of the chela originating from the articulation of the movable finger with the propodus. Juvenile males not only have a smaller chela, the general shape of which resembles that found in adult females, but also lack the vesicle. The development of the vesicles and the enlargement of the claw in the males probably coincides with the onset of sexual maturity.

The size at which the vesicles can be detected on the chelipeds of males more or less coincides in *B. gemmellari* and *B. sexdentatus* with the smallest size recorded for ovigerous females. We can detect vesicles in specimens as small as cl. 5.8 mm in *B. gemmellari*, 5.0 mm in *B. sexdentatus*, and 4.5 mm in *B. foresti*. The smallest ovigerous females collected had carapace lengths of 6.6 mm in *B. gemmellari*, 5.5 mm in *B. sexdentatus* (Stevcic, 1973, reported ovigerous females of 4.9 mm), and 6.5 mm in *B. foresti*.

Ovigerous females of all three species generally are found in warmer months, from May to October. Zariquiey Alvarez (1968) reported that *B. sexdentatus* from Spain was ovigerous between February and October, and Stevcic (1973) noted that in the northern Adriatic females were ovigerous between April and October. In all three species the eggs are dark brown and their diameter is 0.25–0.30 mm.

Habitat Preferences

The three Mediterranean species of *Brachynotus* occupy different ecological habitats and usually do not live together. *Brachynotus foresti* and *B. sexdentatus* are both shallow water species. The former usually is found in the mediolittoral zone among algae or mussels growing on hard substrates, generally in protected waters with little wave influence; apparently it may also dig in sand. *Brachynotus sexdentatus* apparently prefers soft bottoms, also in the mediolittoral zone in depths of less than one meter. It usually is found under stones but it, too, may burrow in sand, as reported by Lewinsohn & Holthuis (1964). Ramadan & Dowidar (1976) found it on silty sand and mud with seaweeds and *Caulerpa*. The third species, *Brachynotus gemmellari*, usually is limited to the lower part of the infralittoral zone, in depths ranging from 4–21 m, on soft, muddy bottoms where its long, slender legs may be advantageous.

Although the apparent habitat preferences of *B. gemmellari* and *B. sexdentatus* suggest that the two species would not be taken together, we found them together in a shallow water, protected habitat in Salammbô, Tunisia. There, in the northernmost of the two Punic Ports, a circular harbor separated from the Bay of Tunis by a narrow channel to the East, the outer edge is made up of rocks on marl or mud and *B. sexdentatus* is commonly found under the rocks. Toward the mouth of the harbor the bottom is of firm sand, but that grades into very soft, deep mud which fills the inner part of the harbor, and here we found *B. gemmellari*. Apparently it can live in shallow water if soft bottoms are present.

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